CLAIMS

1. (previously presented) A method for determining a restoration path corresponding to a primary path for a new service in a mesh network having a plurality of nodes interconnected by a plurality of links, the method comprising:

(A) for each of a plurality of candidate restoration paths associated with the primary path:

(1) for each link in the candidate restoration path:

(i) assigning a link cost to the link;

(ii) determining whether the primary path requires any additional restoration bandwidth to be reserved on the link based on whether the primary path is SRLG-disjoint from each other primary path that is currently protected by that link, wherein:

a shared risk link group (SRLG) is a set of two or more links, for which a failure of any one link in the SRLG is associated with a relatively high risk of failure of the other links in the SRLG; and

two paths are SRLG-disjoint when no two links in the two paths are members of any one SRLG;

(iii) determining that sharing is possible for the link when it is determined that no additional restoration bandwidth is required to be reserved on the link;

(iv) reducing the link cost by a factor R for each link of each candidate restoration path for which sharing is possible, wherein the factor R is a function of a sharing degree for each link; and

(v) when sharing is not possible, then:

(a) determining whether utilization of the link is greater than a specified threshold;

(b) when the link utilization is greater than the specified threshold, then assigning the link cost as a function of an administrative weight for the link and available capacity on the link; and

(c) when the link utilization is less than the specified threshold, then assigning the link cost as a function of the administrative weight for the link; and

(2) generating a path cost for the candidate restoration path based on a sum of the link costs for the links of that candidate restoration path; and

(B) selecting one of the candidate restoration paths for the primary path based on minimum path cost.

2. (original) The invention of claim 1, wherein a failure of any one link in an SRLG is associated with a risk of failure of the other links in the SRLG greater than a specified risk threshold.

3. (original) The invention of claim 1, wherein each candidate restoration path is SRLG-disjoint from the primary path.

4. (previously presented) The invention of claim 3, wherein, for each link in the primary path, the method comprises:

determining whether the link is part of an SRLG; and

when the link is part of an SRLG, then excluding any path having a link in that SRLG from consideration as a candidate restoration path.

5-7. (canceled)

8. (previously presented) The invention of claim 1, wherein the link cost is assigned as a function of an administrative weight for the link.

9. (previously presented) The invention of claim 1, wherein the link cost is assigned as a function of sharing degree.

10. (previously presented) The invention of claim 9, wherein the function of the sharing degree is an approximation to the sharing degree that is calculated using a binary representation of a node-link vector and a binary representation of a primary path node-link vector, wherein the calculation of the approximation comprises:

computing the bitwise AND of the binary representation of the node-link vector and the binary representation of the primary path node-link vector, and

computing the OR of all elements of the resulting vector to determine whether sharing is possible.

11. (original) The invention of claim 1, wherein the sharability of a link in a candidate restoration path is represented by a sharing degree for the link, wherein the sharing degree is a maximum number of additional unit-bandwidth primary services that can be added to the candidate primary path without increasing restoration bandwidth reserved on the link.

12. (original) The invention of claim 11, wherein the sharing degree SD for a link is given by:

SD = the maximum value m for which $\max\{ m \cdot V_{pnl} + V_{nla} \} = \mathrm{RB}$,

wherein:

V_{pnl} is a primary path node-link vector for the corresponding candidate primary path;

V_{nla} is an aggregate node-link vector for the link; and

RB is current reservation bandwidth on the link.

13. (original) The invention of claim 1, wherein the method is implemented for each of a plurality of candidate primary paths to generate a path pair cost associated with the candidate primary path and further comprising selecting one of the candidate primary paths for the new service based on minimum path pair cost.

14. (previously presented) The invention of claim 13, wherein the plurality of candidate primary paths comprises:

K minimum-cost paths for the new service where the path cost of each candidate primary path is calculated as a function of the link costs of the links of the candidate primary path, and the link costs are calculated by:

determining whether utilization of the link is greater than a second specified threshold;

when the link utilization is greater than the second specified threshold, then generating the link cost as a function of an administrative weight for the link and available capacity on the link; and

when the link utilization is less than the second specified threshold, then generating the link cost as a function of the administrative weight for the link.

15-17. (canceled)

18. (previously presented) A method for determining a restoration path corresponding to a primary path for a new service in a mesh network having a plurality of nodes interconnected by a plurality of links, the method comprising:

(A) for each of a plurality of candidate restoration paths associated with the primary path:

(1) determining whether the primary path requires any additional restoration bandwidth to be reserved on any link of the candidate restoration path based on whether, for each link of the candidate restoration path, the primary path is SRLG-disjoint from each other primary path that is currently protected by that link, wherein:

a shared risk link group (SRLG) is a set of two or more links, for which a failure of any one link in the SRLG is associated with a relatively high risk of failure of the other links in the SRLG; and

two paths are SRLG-disjoint when no two links in the two paths are members of any one SRLG; and

(2) generating a path cost for the candidate restoration path, wherein the path cost is a function of whether any such additional restoration bandwidth is required; and

(B) selecting the restoration path for the new service based on the path cost for each candidate restoration path, wherein the sharability of a link in a candidate restoration path is represented by a sharing degree for the link, wherein the sharing degree is a maximum number of additional unit-bandwidth primary services that can be added to the candidate primary path without increasing restoration bandwidth reserved on the link, wherein the sharing degree SD for a link is given by:

SD = the maximum value m for which $\max\{ m \cdot V_{pnl} + V_{nla} \}$ = RB,

wherein:

V_{pnl} is a primary path node-link vector for the corresponding candidate primary path;

V_{nla} is an aggregate node-link vector for the link; and

RB is current reservation bandwidth on the link.

19. (previously presented) A method for determining a restoration path corresponding to a primary path for a new service in a mesh network having a plurality of nodes interconnected by a plurality of links, the method comprising:

(A) for each of a plurality of candidate restoration paths associated with the primary path:

(1) determining whether the primary path requires any additional restoration bandwidth to be reserved on any link of the candidate restoration path based on whether, for each link of the candidate restoration path, the primary path is SRLG-disjoint from each other primary path that is currently protected by that link, wherein:

a shared risk link group (SRLG) is a set of two or more links, for which a failure of any one link in the SRLG is associated with a relatively high risk of failure of the other links in the SRLG; and

two paths are SRLG-disjoint when no two links in the two paths are members of any one SRLG; and

(2) generating a path cost for the candidate restoration path, wherein the path cost is a function of whether any such additional restoration bandwidth is required; and

(B) selecting the restoration path for the new service based on the path cost for each candidate restoration path, wherein the method is implemented for each of a plurality of candidate primary paths to generate a path pair cost associated with the candidate primary path and further comprising selecting one of the candidate primary paths for the new service based on minimum path pair cost, wherein the plurality of candidate primary paths comprises:

K minimum-cost paths for the new service where the path cost of each candidate primary path is calculated as a function of the link costs of the links of the candidate primary path, and the link costs are calculated by:

(i) determining whether utilization of the link is greater than a specified threshold;

(ii) when the link utilization is greater than the specified threshold, then generating the link cost as a function of an administrative weight for the link and available capacity on the link; and

(iii) when the link utilization is less than the specified threshold, then generating the link cost as a function of the administrative weight for the link.

20. (currently amended) A method for determining a minimum-cost restoration path corresponding to a new primary path for a new service in a mesh network having a plurality of nodes interconnected by a plurality of links, the method comprising:

(A) for each link of a specified set of links in the network:

(1) assigning an initial cost to the link;

(2) determining whether the link's bandwidth can be shared with a new restoration path for the new primary path; and

(3) reducing the link's assigned initial cost when it is determined that the link's bandwidth can be shared with the new restoration path; and

(B) calculating the minimum-cost restoration path for the new primary path using the specified set of links, wherein the cost of the minimum-cost restoration path is based on the sum of the costs of the links of the minimum-cost restoration path.

21. (previously presented) The method of claim 20, wherein the specified set of links excludes links in the network that are not SRLG-disjoint from the links of the new primary path, wherein:

a shared risk link group (SRLG) is a set of two or more links, for which a failure of any one link in the SRLG is associated with a relatively high risk of failure of the other links in the SRLG; and

two links are SRLG-disjoint when they are not members of any one SRLG.

22. (previously presented) The method of claim 21, wherein the exclusion of links in the network that are not SRLG-disjoint from the links of the new primary path is accomplished by assigning an infinite initial cost to those links.

23. (previously presented) The method of claim 20, wherein:

the method is implemented for each of a set of candidate primary paths, wherein a path pair cost is generated for each candidate primary path as the sum of the path cost of the candidate primary path and the path cost of the corresponding minimum-cost restoration path; and

the method further comprises selecting (i) a candidate primary path from the set of candidate primary paths and (ii) the corresponding minimum-cost restoration path that together have the lowest path pair cost.

24. (currently amended) A network manager for a mesh network having a plurality of nodes interconnected by a plurality of links, the network manager adapted to determine a minimum-cost restoration path corresponding to a new primary path for a new service in the mesh network by:

(A) for each link of a specified set of links in the network:

(1) assigning an initial cost to the link;

(2) determining whether the link's bandwidth can be shared with a new restoration path for the new primary path; and

(3) reducing the link's assigned initial cost when it is determined that the link's bandwidth can be shared with the new restoration path; and

(B) calculating the minimum-cost restoration path for the new primary path using the specified set of links, wherein the cost of the minimum-cost restoration path is based on the sum of the costs of the links of the minimum-cost restoration path.

25. (previously presented) The network manager of claim 24, wherein:

a first link in the network is part of two or more different restoration paths, wherein each restoration path corresponds to a different primary path;

the network manager makes use of sharing information to determine how much protection bandwidth to reserve on the first link for the two or more restoration paths in such a way that the restoration bandwidth reserved on the first link is shared between the restoration paths of the two or more different primary paths.